THE ANKLE-JOINT IN MAN, AND THE INHERITANCE OF ACQUIRED CHARACTERS.

PROF. RETZIUS has lately published an account of certain observations on the fœtus of Swedes, which, in connection with similar observations recorded by Surgeon Havelock Charles on the Punjabite, he believes to support the Lamarckian view that acquired characters are inherited. He endeavours to show that the evidence in support of the theory is to be found in our own skeletons.

Some years ago, Prof. Arthur Thomson pointed out that in certain races of men who habitually adopt a "squatting position," the tibia and astragalus present additional articular facets, allowing greater flexure of these bones upon one another, than is possible (or at any rate normal) in Europeans and other civilised races who have given up squatting, and in which these facets are absent. Accompanying these facets there is a retroversion of the head of the tibia. Both these characters are present in apes and in certain prehistoric races, and Surgeon Havelock Charles described, a year or two back, a series of instances of their presence not only in the adult Punjabite, but in the fœtus. At the meeting of the British Association at Oxford, Prof. A. Macalister exhibited these specimens, as well as similar specimens taken from British infants, and a discussion followed on the meaning of these peculiarities. Now Retzius ("Ueber die Vererbung erworbener Eigenschaften," *Biol. Untersuch*, n.f. vii.) records these same characters in fœtal Swedes, from an early age, even up to eight months; and reviewing the facts, he comes to the conclusion—in which I think most of us would agree—that the presence of these characters, viz. the retroversion of the head of the tibia and "Thomson's facets" is a more primitive condition than their absence in normal Europeans of the present day; that they have been inherited from early times; and in those peoples which habitually adopt the "squatting" position they have become gradually further developed. This last conclusion is perhaps open to question; it is quite possible that even in these races they are less developed than in ancestral forms. But Retzius proceeds to contend that Europeans have undergone gradual change in their skeletons from generation to generation; they no longer sit on their haunches, and have gradually lost the power to do so, and as a consequence "Thomson's facets" have disappeared; and he concludes that "it is, therefore, we Europeans who, on account of changed habits, have undergone changes, and it is in us that these changes have gradually been inherited."

But here, it seems to me, that Darwinians would join issue with Retzius. His own and other observations show that the *changes* are not inherited; for the characters of the bones are inherited from the ancestral ape-like forms, and it is, surely, only on account of individual habit that the peculiarities are not present in the adult.

It is by no means clear what is the "acquired" character on which Retzius hangs his views. Is it the osteological peculiarity, or the habit of using chairs to sit upon, instead of employing the squatting posture? His own researches show that the osteological characters are *not* acquired, whilst the habit of walking upright and sitting on chairs is distinctly acquired, and it is in relation to this acquirement that the osteological peculiarities cease to be evident. Young children, as we know, can and do sit upon their haunches, and can move their legs and ankles in a way that an adult, unless he is fairly athletic, finds it impossible to do; and it appears probable that the disappearance of the facets in the adult is closely connected with the ossification of the bone, which will obliterate the facets now no longer brought into use. It would be interesting to examine in this connection the leg-bones of "contortionists" and others who make a free use of their legs and ankles, for a very little practice enables even civilised men to employ exaggerated movements of their limbs.

Another point to which attention might be directed (which indeed may have been looked into) is the character of the articulation of the bones of the great toe in those races which make use of this digit. A casual observation on the skeleton of an Andaman shows that the articular surface of the first metatarsal with the entocuneiform is distinctly more rounded than in a European; a feature in which there is an approach to the condition in the apes. It might have been presumed that some difference, similar to that in Europeans and Punjabites, would be found in digitigrade and plantigrade mammals; but the result of a brief examination of skeletons of such forms is sufficiently surprising to be referred to; for instance, in the lion there is a facet of the same kind as, but not really homologous with Thomson's facet, at the lower end of the tibia. This is absent in the bear and the dog; it is also absent in the sea-otter. It is present, however, in the beaver and other rodents; it exists in some ruminants, as well as in the horse, but is only slightly developed in the tapir, and is absent in the Suidæ.

THE PARIS OBSERVATORY.

M. TISSERAND'S report on the work accomplished in the Paris Observatory during 1895 has come to hand. The principal points referred to are indicated in the subjoined summary.

The revision of the right ascensions of the fundamental stars of the Paris Catalogue is completed, and the revision of the polar distances was commenced in May of last year.

During the year, MM. Henry obtained 319 plates for the photographic star catalogue, which number brings the total up to 1155. Eighty-eight plates, containing 35,814 stars, were measured under the direction of Mlle. Klumpke, and the measures of 13,663 stars upon forty-three plates previously obtained were reduced for the catalogue of the photographic chart.

The great Coudé equatorial has been used whenever possible in lunar photography, in order to complete the series of photographs of the moon required to make a large-scale map of our satellite. The photographs already obtained have been enlarged and reproduced by heliogravure by MM. Fillon and Heuse. The first fasciculus of the photographic chart of the moon, which MM. Lœwy and Puiseux have in hand, containing six sheets, five of which will represent parts of the moon on a scale of 2·60 metres to the lunar diameter, will shortly be issued. The present report contains a heliogravure representing an unenlarged photograph of the moon obtained in February 1894. The picture is a most striking one, reproducing faithfully and beautifully the chief features of the lunar surface.

M. Deslandres has continued his photography of the solar chromosphere. He has also investigated the subject of the displacement in the lines of the spectrum of Jupiter, produced by the planet's rotation. A note upon this subject appeared in NATURE in March 1895 (vol. li. p. 443). In the first measures made by M. Deslandres, the equator of the planet was allowed to lie along the slit of the spectroscope, and the inclination of the lines produced by approach and recession of opposite ends of the equatorial diameter were determined. The method now followed consists in measuring the inclination of the lines in the planet's spectrum with reference to neighbouring lines of terrestrial origin, The mean of the measures thus made gives 48±1 kilometres as the difference of velocity of two opposite points on Jupiter's equator. From the known time of rotation of the planet, and the length of the equatorial diameter, the velocity deduced is 49·6 kilometres. The same method has been applied by M. Deslandres to Saturn's disc and rings.

Reference is made to the spectroscopic photographs of the velocity of Altair in the line of sight. The photographs give evidence of differences in the radial velocity, even when the mean error of observation is considered. These variations have a period of about forty-three days, and a secondary period of about five days. The conclusion arrived at from an examination of the spectra is that Altair is in orbital motion under the influence of one or more unknown bodies. The star β Ursæ Minoris also shows variations of velocity in the line of sight which cannot be accounted for by errors of observation.

In addition to the matters referred to in the foregoing, the usual meridian work, and observations of comets and minor planets, as well as meteorological observations, were carried on during 1895, and the chief results obtained are stated in the report.

CABLE LAYING ON THE AMAZON RIVER.[1]

WHEN it had been decided to connect Belem, the capital of the State of Pará, by means of a subfluvial cable with Manaos, the capital of the State of Amazonas, a preliminary journey became necessary, during which landing-places at the various intermediate stations had to be selected, some reaches of the river explored, as no trustworthy charts exist, and various

[1] Abridged from a discourse delivered at the Royal Institution by Mr. Alexander Siemens.

other details ascertained in order to facilitate the laying of the cable.

This preliminary survey took place in October of last year during the hottest season, when the river was at its lowest; while the cable was laid during January and February of this year, when the rainy season had commenced and the river was rising.

It is extremely difficult to realise the true proportions of this river, but the subjoined comparative table, in which the dimensions of the principal rivers of the various continents are contrasted with those of the Amazon, will help to show the importance of this great system of natural waterways.

With several other large rivers the Amazon shares the fate that its name changes several times during its long course, and that at various times different affluents have been considered to be the true source of the main stream.

Most geographers, however, regard the Marañon as the principal river, a branch of which, called Tunguragua, rises in Lake Lauricocha in Peru in 10° 30′ S. lat., and 76° 10′ W. long.; although the Ucayale, where it unites with the Marañon at Nauta (4° S. lat., 73° W. long), is quite as important as the Marañon.

Name.	Length in statute miles.	Watershed. Square miles.	Average discharge cubic feet per second.	Length of navigable waters in miles.
Mississippi ...	2616 [1]	1,285,300 [6]	675,000	35,000
La Plata ...	2400	994,900 [6]	700,000?	20,000
St. Lawrence	2200	565,200 [6]	1,000,000 [7]?	2,536
Nile	3370	1,293,050 [6]	61,500	3,000 [3]
Volga	2325	592,300 [6]	384,000 [2]	14,600
Danube ...	1735	320,300 [6]	205,900	1,600 [3]
Rhine	810	32,600 [6]		550 [3]
Thames ...	210	6,010	2,220 [4]	200 [3]
Amazon ...	2730 [5]	2,229,900 [8]	2,400,000	50,000

(1) To source of Missouri 4300 miles.
(2) At Saratoff.
(3) Exclusive of tributaries.
(4) At Teddington.
(5) To source of Apurimac 3415 miles.
(6) According to Dr. John Murray.
(7) According to Darby, the American hydrographer.
(8) According to *Encyc. Britt.*

Area of Great Britain and Ireland	120,626
,, British India	1,560,160
,, Brazil	3,219,000
,, Europe	3,790,000

If the greatest distance from the mouth is to decide the question, then the source of the Apurimac, an affluent of the Ucayale, can lay claim to being the origin of the Amazon, rising in Peru in 16° S. lat., and 72° W. long.

Along the whole course of the Amazon, commencing at the foot of the Andes, a network of islands and canals is formed on both sides of the river, as the whole country is almost level, and is consequently inundated during the rainy season for hundreds of miles by the rivers flowing through it The most notable exception to this general state of things occurs at Obidos, where the whole volume of water is compressed into one channel a little over a mile wide, and said to be about forty fathoms in average depth A sounding taken opposite Obidos, about a third of the distance across the river, showed a depth of fifty-eight fathoms, measured by a steel wire and Lord Kelvin's sounding-machine. As the current of the river averages three knots in the main channel, it is not easy to take soundings by an ordinary lead line; and even with the steel wire an extra heavy weight (33 lb.) has to be employed, or the results are not trustworthy.

Besides the wire sounding-machine a submarine sentinel was used on the preliminary voyage, wherever serious doubts existed about a channel through which the cable was to be laid. This apparatus consists of a small winch from which a wire leads into the water and drags at a short distance behind a piece of wood, shaped like an angle-iron, in a nearly upright position. The wire is not attached directly to the piece of wood, but to a string kite-fashion, and the wood is fitted with an iron foot which, on coming in contact with the bottom of the water, releases one end of the kite-string, so that the wood remains attached to the winch wire with one end only. The consequence is that the strain on the wire is suddenly reduced to a very small amount, and the piece of wood appears on the surface of the river. It depends on the quantity of wire paid out how deep the kite or the sentinel floats, and its action is quite trustworthy, so that it is unnecessary to take soundings by the line or by wire while the sentinel is being dragged by the ship. Usually the sentinel was set at five fathoms, and when it struck a bar the ship was stopped, and a series of soundings taken to ascertain the exact depth of water, and the extent of the shallow place.

A further difficulty in sounding originated from the soft nature of the soil, which for the greater part of the Amazon valley is alluvial clay, and allows the lead to sink into it for several feet. In the narrows there appears, however, a bank of hard clay (called Tabainga) which, unfortunately, blocks nearly all the branches of the narrows, and creates bars all along the course of the Tajipuru, the main westerly waterway connecting to the Gurupá branch of the main river. Occasionally the same hard clay forms shallows in the main river, but as a rule the section of all the channels resembles the capital letter U, *i.e.* the sides are very steep and the bottom flat. In this respect, as in many others, the Amazon differs entirely from the Indian rivers, which build up their beds above the surrounding country, occasionally breaking through their natural banks and seeking a new bed. The Amazon, on the other hand, carries with it only the light clay sediment which forms the soil of the whole valley; and the inducement for the main stream to alter its course is therefore very small, and long straight reaches are the result.

Under these circumstances the largest vessels can ascend the river nearly to the foot of the Andes, but the constantly-changing sandbanks at the mouth of the Amazon proper make this approach of the river dangerous, and the State of Pará is, for obvious reasons, not over-anxious to have the deep channels properly buoyed and surveyed. This forces all the shipping to enter the Pará River, and to pass the narrows if the Amazon is the goal of the journey. In doing the latter, the choice for large ships lies between one of the channels (called Furos) with a bar, where it joins the Tajipuru, and a furo (the Macajubim) which has plenty of water, but which winds about in such a serpentine fashion that only ships with twin screws can pass it unassisted.

These difficulties are, however, much diminished during the rainy season, when the river rises to such an extent as to drive all the inhabitants of its banks into the towns, which have been built wherever a natural eminence secured the inhabitants against the flood. Near the mouth the difference is naturally not so great as higher up, where the influence of the tide is felt less; but at Manaos the difference in level between low river and high river exceeds forty feet.

With all rivers carrying sediment the Amazon shares the peculiarity that its immediate banks are higher than the country lying behind them, and thus we have in the rainy season the spectacle of the main river flowing between two banks covered with dense forest, and immense lakes stretching out on either side of these banks. These do not entirely dry up during the remainder of the year, so that the whole of the Amazon valley really forms a huge swamp covered with a most luxuriant forest, which below Manaos narrows to a broad belt close to the main river with prairies, called Campos, at the back of the forest stretching out to the hills, where the forest recommences. In such a country no land communication of any sort can be attempted, as the tropical vegetation and the annual inundations of the rivers destroy everything that man places in the way of the natural forces. By water, on the other hand, the intercourse between all habitable parts of the country is easy and expeditious since steamers were introduced in the year 1853. Belem, the capital of the State of Pará, lies on a branch of the Pará River, called Guajará, which unfortunately does not share the characteristic shape of the Amazon and the furos, but forms a rather shallow basin in front of the town.

The first station on the main cable is Breves, the centre of the rubber trade of the islands of the lower Amazon, situate in the centre of "the narrows."

In Gurupá, the second station of the main line, the inhabitants expressed their joy at being put in communication with the rest of the world by actively helping in the landing of the first shore end.

During an enforced sojourn near the mouth of the Boinasu, in the midst of the most wonderful combination of islands and rivers, the two naturalists, which the British Museum authorities had kindly sent with the expedition, took full advantage of the opportunity to explore the locality in all directions.

In the rubber-gathering industry, which is at once the wealth and bane of this part of the world, the implements in use are of the most primitive kind, but the average earnings can easily be three pounds per day during the dry season, and the facility of earning so much money with little exertion makes the inhabitants unwilling to engage in more arduous labour.

A narrow path leads from the hut on the water's edge into the forest from one rubber-tree to another, the path eventually returning to the hut. The trees are cut on the morning round, and the rubber is gathered in the afternoon. As soon as it arrives at the hut a fire of oily palm-nuts (*Attalea excelsa*) is lighted, and the thin sap thickened in the smoke For this purpose a paddle is used, on to which the sap is poured with a small earthenware or tin vessel. The smoke soon thickens it, and a new layer is poured on until the well-known flat cakes of india-rubber have been formed.

Owing to the rise of the river during the rainy season most of the huts have to be abandoned, and it can easily be imagined how comfortless they are. Nearly all of them are built on piles, and most of them are thatched with palm-leaves. There is hardly any attempt made to cultivate the soil, such as it is, but everything is imported. The s.s. *Cametense*, in which the surveying party went out, was laden with cabbages, onions, and potatoes, part of which went as far as Iquitos in Peru.

Chiefly owing to this want of provisions, and to the generally careless mode of life, the mortality among india-rubber gatherers is very great.

Everything Bates and Wallace have said of this region remains as true as it was forty years ago, and hardly anything new can be added to their description of the general features of the Amazon valley; but the town of Manaos has completely changed its character since it was made the capital of that region in 1853. A town quite European in its features has arisen in the midst of the forest, and to the benefits of rapid transport, to which it has owed so much, there is now added the characteristic lever of modern progress, the annihilator of space and time—electrical communication.

NOTES ON CLOUDS.[1]

THERE are two points connected with clouds on which I wish to make a few remarks. The first is on the classification of clouds, and the second on the manner in which certain forms of clouds are produced. It may be as well to remark at the outset that the observations are those of an "outsider," being in a department of meteorology to which I have given but little attention, and they have been written with a view of calling the attention of specialists, and getting their opinion on the subject.

It appears to me that in classifying clouds they ought first of all to be divided into two great classes. In the one class should be placed all clouds in the process of *formation*, and in the other those in the process of *decay*. The two classes might be called *Clouds in Formation* and *Clouds in Decay*. We may take Cumulus clouds as an example of the former, and Nimbus of the latter. My observations made on the clouds themselves have shown that there is a difference in the structure of these two classes of clouds. In clouds in formation the water particles are much smaller and far more numerous than in clouds in decay; and while the particles in clouds in decay are large enough to be seen with the unaided eye when they fall on a properly lighted micrometer, they are so small in clouds in formation that, if the condensation is taking place rapidly, the particles cannot be seen without the aid of a lens of considerable magnifying power. In the former case the number of particles falling per square millimetre is small, while in the latter they are so numerous that it is impossible to count them.

It appears that one good end might be served by adopting this classification. It would direct the attention of observers more to looking on the processes going on in *decay* for an explanation of many of the forms observed in clouds. In most books on clouds, when describing the different shapes of clouds, it is almost always assumed that they are in process of *formation*, and the whole explanation of the shapes taken by the clouds is founded on this supposition. Now, it is very evident that very many clouds are in the process of decay, and their forms can only be explained by the processes going on under these conditions.

This brings me to the second point in this communication, namely, the manner in which ripple-marked cirrus clouds are produced. The explanation which has generally been accepted of the formation of this form of cloud is, that the ripple markings are due to the general movements of the air giving rise to a series of eddies, the axes of the eddies being horizontal, and roughly parallel to each other. It is very evident that the air revolving round these horizontal axes, that is, in a vertical plane, will at the lower part of its path be subjected to compression, and at the upper part to expansion. The result of this will evidently be, supposing the air to be nearly saturated with moisture, a tendency for cloudy condensation to take place in the air at the upper part of its path, and it is this cloudy condensation in the upper part of the eddies that is supposed to produce the ripple-like cirrus; each ripple mark indicating the upper part of an eddy. One objection I have always felt to this explanation is, that it is difficult to imagine that the small amount of elevation and consequent expansion and cooling could give rise to so dense an amount of clouding as is generally observed. Any clouding produced in this way one would expect to be extremely thin and filmy. I have for the last few years made frequent observations of these clouds, and I have to admit I have never once seen them in the process of formation, or seen one appear in a clear sky. In all cases that have come under my observation, these ripple clouds have been clouds in decay. They are generally formed out of some strato-cirrus or similar cloud. When we observe these strato-cirrus clouds in fine weather, it will be found that they frequently change to ripple-marked cirrus clouds before vanishing. The process of their formation would seem to be: the strato-cirrus gradually thins away till it attains such a depth, that if there are any eddies at its level, the eddies break the stratus cloud up into parallel or nearly parallel masses, the clear air being drawn in between the eddies. It will be observed that this explanation requires the eddies, but not to produce the clouding, only to explain the breaking up of the uniform cirrus cloud into ripple cirrus.

One thing which supports this explanation is, that lenticular-cirrus clouds are frequently observed with ripple markings on one or more sides of them just where the cloud is thin enough to be broken through by the eddies. If we watch these lenticular-formed clouds under these conditions, we frequently see the ripple markings getting nearer and nearer the centre as the cloud decays; and at last, when nearly dissolved, the ripple markings will be seen extending quite across the cloud. It seems probable that "mackerel" and other cloud forms may be produced in the same way.

The shapes which these ripple cirrus clouds assume are much more varied than is generally supposed. I lately observed a most interesting form in the south of France while the mistral was blowing strongly. There were a few cirrus clouds in the sky at the time, and one of these was rapidly being broken up into irregular ripple forms, but at one point there was formed a most perfectly cylindrical-shaped piece, its length being about twenty times its diameter. The whirling effect of the eddy was very evident by the circular streaking of the clouding. Further, this cloud was evidently hollow, that is, the interior was filled with clear air as the cloud was thinnest along the axis, and it had all the appearance of a revolving tube of cloudy air.

It is not contended here that ripple clouds are never produced in the manner which has generally been accepted, only that so far as my observations go they have never been observed forming in the manner supposed. It is hoped that others will put the explanation here offered to the test of observation, and it is principally with a view of getting others to repeat the observations that this has been written.

[1] Paper read by John Aitken, F.R.S., to the Roy. Soc. of Edin. on May 4.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—In the Mathematical Tripos List published on June 16, Mr. W. G. Fraser, of Queens', is Senior Wrangler, Messrs. Barnes, Carson, and Wilkinson, all of Trinity, are bracketed for the second place, and four members of St. John's, Messrs. Edwardes, Houston, Cook, and Turner, follow in two brackets, fifth and seventh. Miss Longbottom, of Girton, has the twelfth place.

In Part II. seven names appear in the first division of the first class, beginning with Mr. Bromwich, of St. John's, the Senior Wrangler of last year.

Mr. A. C. Dixon, of Trinity College, has been approved for the degree of Doctor of Science, in consideration of his mathe-